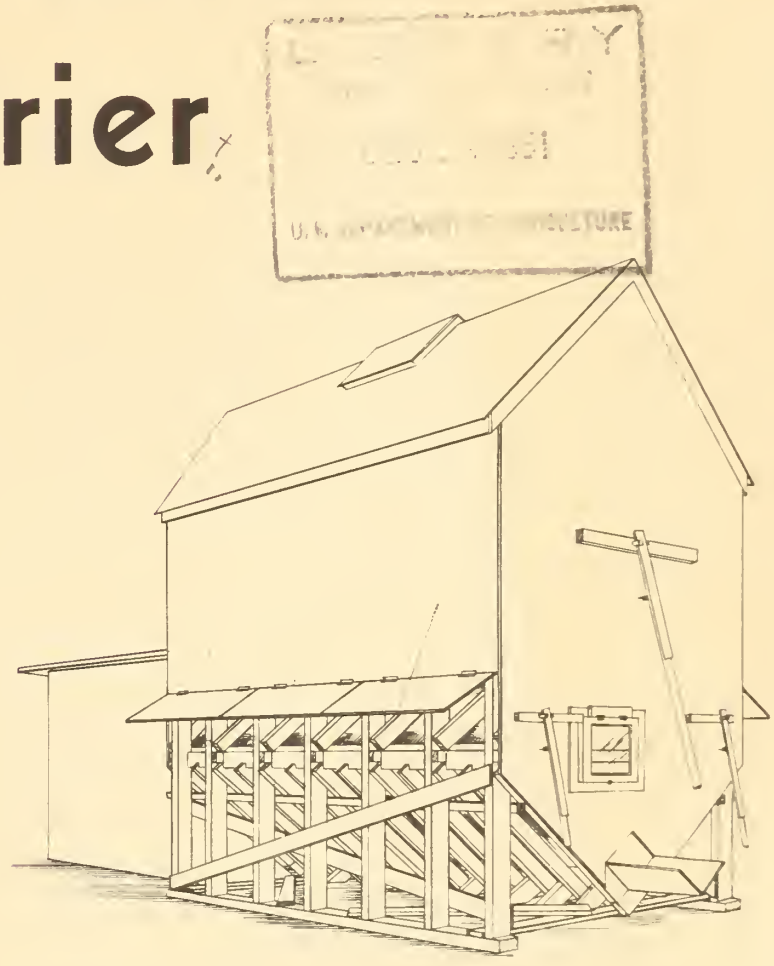
Inclined-Column Grain Drier



Leaflet No. 314

Issued November 1951
U. S. DEPARTMENT OF AGRICULTURE

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HERE is a plan from which you can build a batch-type column drier that will give you continuous drying. One batch of wet grain is dried while a previously dried batch is cooling in the lower cooling chamber. The fan and motor used for drying wet grain and cooling dried grain are enclosed in an airtight shed attached to the drier. Both the cooling chamber and the drying chamber are screened. The fan pulls cool air through the warm, dry grain and pushes heated air through the wet grain, allowing continuous operation of the burner.

This means better efficiency because heat from the warm, dry grain helps dry the wet batch of grain, there is little heat loss from the burner, and even the heat from the electric motor is used for drying. It is not necessary to shut off the burner when cooling a batch.

The drying and cooling chambers are inclined to allow gravity flow of the grain.

This type of drying procedure is well adapted for drying shelled corn harvested with a field picker-sheller. However, a regular sheller can be used at the field or at the drier.

Additional information concerning drying units, field picker-shellers, fans, and elevators can be obtained from your county extension agent, the agricultural engineering department at your State college, or the Division of Farm Buildings and Rural Housing, Agricultural Research Center, Beltsville, Md.

HOW THE DRIER WORKS

1. Wet-harvested grain is placed in the holding bin above the drier. This hopper-bin should be large when no overhead bins are available and small when the drier is located below overhead bins.

2. The drying chamber is filled by pulling a slide under the hopper and letting the grain fall into the drying chamber. This slide should remain open to keep the chamber full and prevent air loss as grain settles during drying.

3. When the grain is nearly dry but before it has cooled, the upper slide is closed and the grain is dropped from the drying chamber into the cooling chamber through the lower set of slides.

4. Another batch of wet grain is immediately dropped into the drying chamber without stopping the fan or burner. It takes but a moment.

5. Outside air is pulled through the warm grain in the cooling chamber. This air is then heated and forced through the next batch of wet grain. One batch cools and another dries at the same time.

6. The burner may not operate properly unless the slide in the shed wall is adjusted to allow some air to by-pass the grain in the cooling chamber. It is not necessary for the fan to pull all the air through the cooling chamber, because the warm grain will cool faster than the wet grain will dry. The slide adjustment is particularly important when drying small grain, which provides greater resistance to air flow than shelled corn or soybeans. This reduced air volume will also require less fuel to heat it to the proper drying temperature.

7. Cooled grain is moved from the cooling chamber, usually with an auger, to an elevator that conveys it to a storage bin or truck. This takes from 10 to 20 minutes, and drying goes on all this time.

8. To finish drying a day's run, it may be necessary to empty only partially the drying chamber. This will insure the drying chamber being full for drying the last small batch.

Capacity of the Drier

The drier was originally designed with 12-inch columns. Later tests showed that 18-inch columns, shown in the plan (inside), are satisfactory, particularly for shelled corn, and provide more capacity for the 12-foot drier holding about 150 bushels in the drying chamber. Most fans operated with a 5-hp. electric motor will furnish these amounts.

If the dried grain is to be used for feed, somewhat higher drier temperatures may be used. Temperatures above 160° F. will increase the fire hazard. The drying temperature should not exceed 100° to 110° F. if grain is to be used for seed. The heated-air temperature should be checked when both the drying and cooling chambers are full of grain. Unless the burner is equipped with a thermostatic control, the temperature will rise when the cooling chamber is full because of decreased air flow and added heat from the warm grain in the cooling chamber.

Two small elevators are needed for moving the grain into and out of the drying building. These elevators may be of the cup, flight, auger, or pneumatic type. A 28- to 30-foot elevator will fill the holding bin, and a 24- to 34-foot elevator will fill the storage bins, depending on the kind of bin and location.

Because of the dependability and economy of electric power, it may be used for all the power requirements of the drier and conveying equipment. The power supplier should be contacted to check transformer capacity and wire size for this installation. As there is some fire hazard in connection with any drier, the unit should be located with this in mind.

HOW TO BUILD DRIER

1. Place 4- by 6-inch skids (concrete foundation and sills may be used).

2. Assemble on the ground the studs and joists for each 2-foot section. Make sure that the two end sections have the joists on the outside of the studs as shown in the plan. Siding can then be easily attached after blocking is nailed to studs.

3. Set up sections and install upper plate (fig. 1).

4. Add 2- by 4-inch supports between 2- by 4-inch supports under cooling chamber (see plan).

5. Attach 1/4-inch hardware mesh and metal fly screen to upper part of drying chamber and lower part of cooling chamber as shown in plan. Perforated metal with correct size of openings can be used in place of screen and mesh.

6. Build "A" frame sections for drying and cooling chambers

tests showed that 18-inch columns, shown in the plan (inside), are satisfactory, particularly for shelled corn, and provide more capacity per foot of length. The 12-inch columns are satisfactory where only small grains are to be dried, and plans for such driers are available from the University of Illinois, Urbana.

The 18-inch columns will hold from 12 to 14 bushels and the wet-grain hopper from 28 to 32 bushels for each foot of drier length. The length can be varied, with 8 feet a recommended minimum and 14 feet about the maximum for uniform filling through a central roof-hatch and for easy operation of grain slides.

Heater and Fan

The required size of heater will depend on (1) the number of bushels to be dried each hour, (2) the amount of moisture to be removed, and (3) the temperature of the drying air. The following examples show estimated amounts of fuel oil needed to dry 50 bushels (56 pounds per bushel) of wet, shelled corn or small grain an hour.

Amount of moisture to be removed:	*Gallons of fuel oil per hour*
From 28 percent to 17 percent	6 to 7
From 28 percent to 12 percent	9 to 10
From 24 percent to 14 percent	5 to 6
From 24 percent to 12 percent	6 to 6½
From 20 percent to 12 percent	4 to 5

The estimates assume that a gallon of fuel will evaporate between 50 and 55 pounds of water from grain. Actual evaporation rate will vary with the efficiency of the drying set-up.

The amount of oil must be doubled to dry 100 bushels an hour under these conditions. In many cases this would require a heater too large to be practical. Most farm-type drying units will have fuel capacities ranging between 5 and 10 gallons an hour.

The fan should deliver sufficient air to prevent drying temperatures from rising above 130° to 140° F. if dried grain is to be marketed. An estimated air delivery of between 40 and 60 cubic feet of air a minute for each bushel of grain in the drying chamber will be needed under the drying conditions listed above. A fan delivering between 6,000 and 9,000 cubic feet of air per minute against a static pressure of 1 to 2½ inches of water will be needed

6. Build "A" frame sections for drying and cooling chambers. Dimensions are as shown in plan.

7. Install lower "A" frame first so that fastening can be done from drying chamber; place blocking between joists as shown in plan.

8. Install between drying and cooling chamber an airtight floor, preferably one that is fire-resistant (see fig. 2).

FIGURE 1.—Each 2-foot section of studs and joists can be assembled on the ground and then raised into position on skids or sills as shown.

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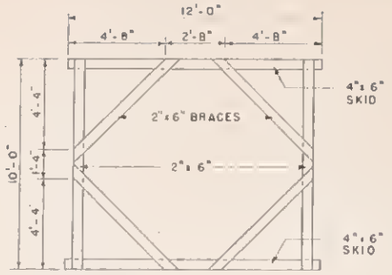
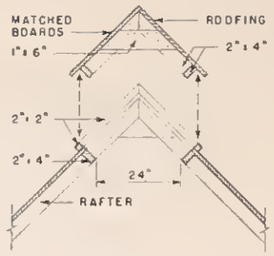
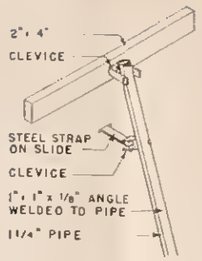


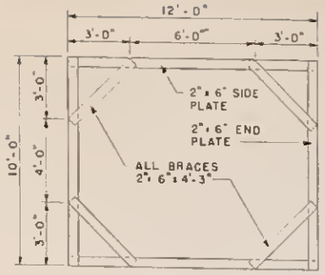
SKIO BRACE OETAIL
(A)



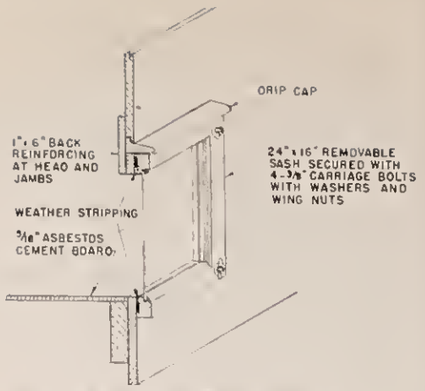
HATCH OETAIL
(B)



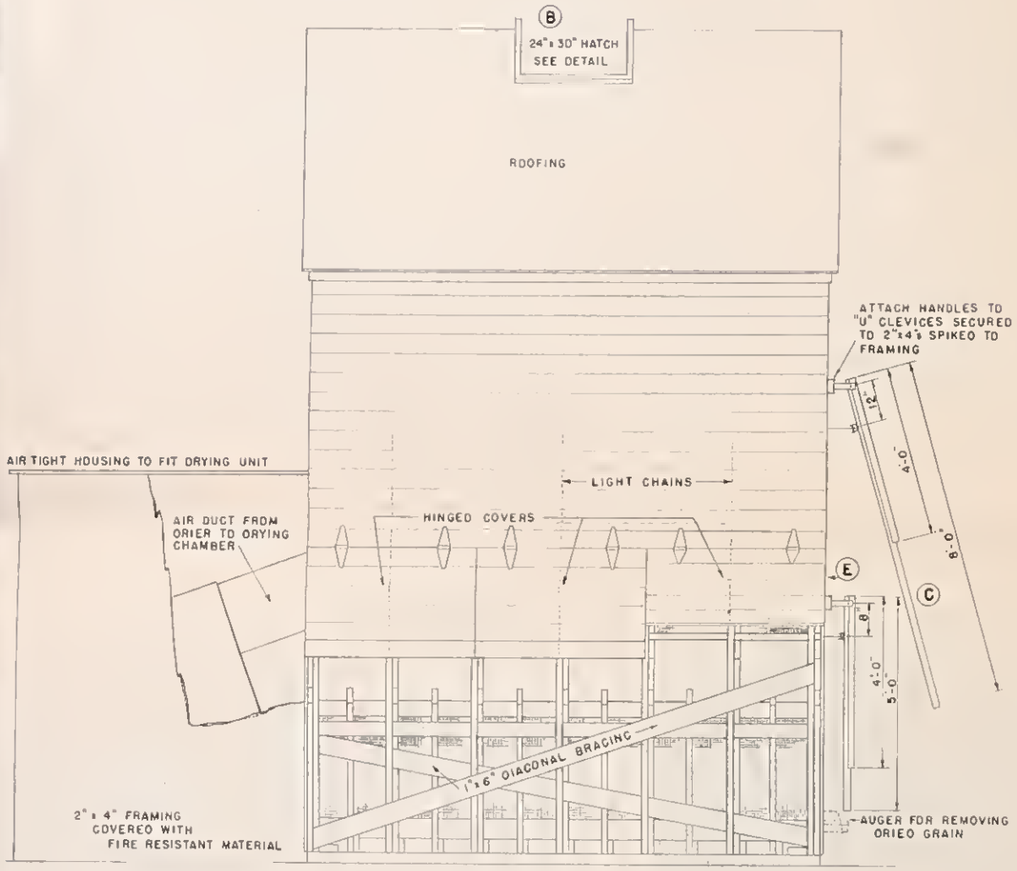
SLIDE LEVER DETAIL
(C)



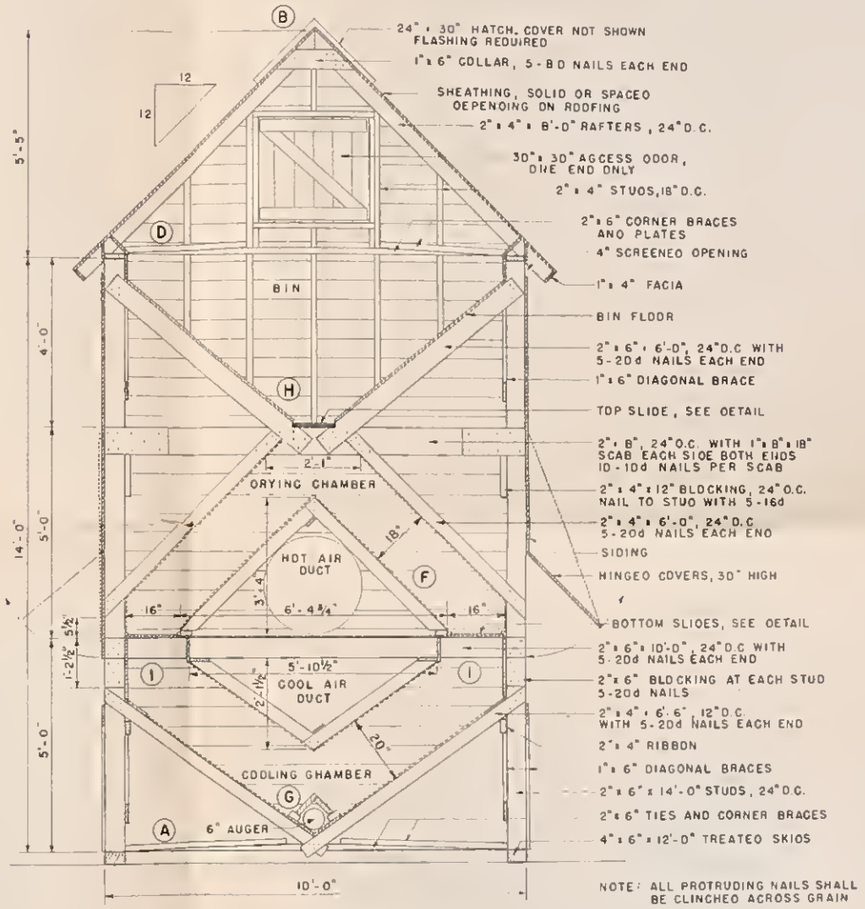
CORNER BRACES AT PLATE
(O)



OETAIL OF AIR TIGHT INSPECTION WINDOW
(E)

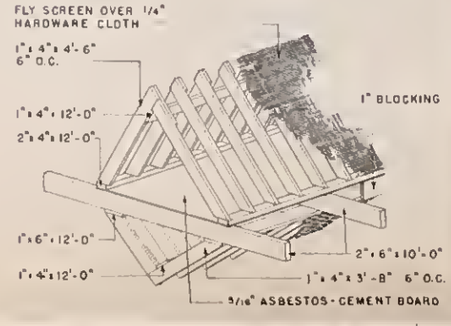


SIDE ELEVATION

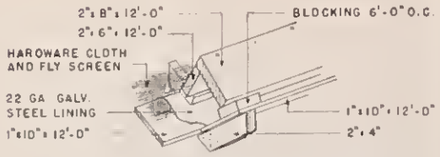


NOTE: ALL PROTRUDING NAILS SHALL BE CLINCHED ACROSS GRAIN

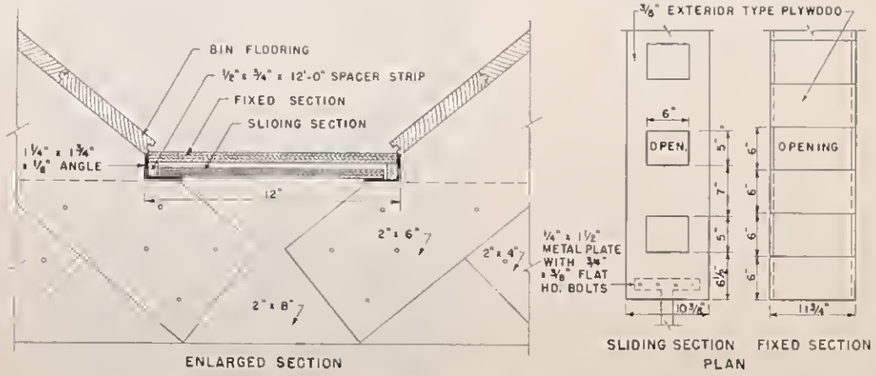
TYPICAL CROSS SECTION



VIEW OF A-FRAMING FOR AIR DUCTS
(F)



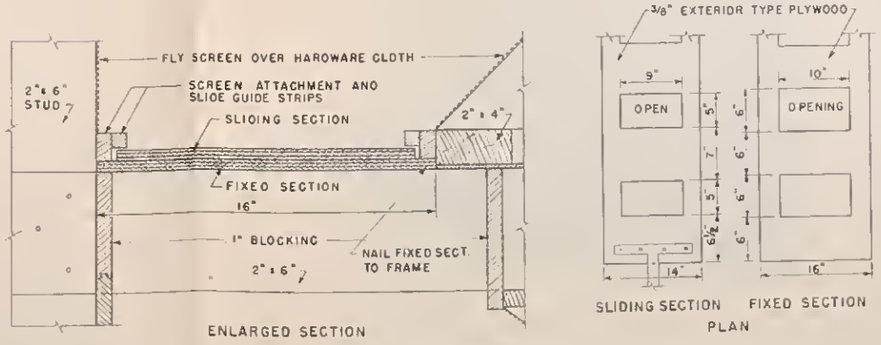
VIEW OF AUGER TROUGH AND COVER
(G)



ENLARGED SECTION

SLIDING SECTION FIXED SECTION
PLAN

TOP SLIDE DETAILS
(H)



ENLARGED SECTION

SLIDING SECTION FIXED SECTION
PLAN

BOTTOM SLIDE DETAILS
(I)

HOW THE DRIER WORKS

1. Wet-harvested grain is placed in the holding bin above the drier. This hopper-bin should be large when no overhead bins are available and small when the drier is located below overhead bins.

2. The drying chamber is filled by pulling a slide under the hopper and letting the grain fall into the drying chamber. This slide should remain open to keep the chamber full and prevent air loss as grain settles during drying.

3. When the grain is nearly dry but before it has cooled, the upper slide is closed and the grain is dropped from the drying chamber into the cooling chamber through the lower set of slides.

4. Another batch of wet grain is immediately dropped into the drying chamber without stopping the fan or burner. It takes but a moment.

5. Outside air is pulled through the warm grain in the cooling chamber. This air is then heated and forced through the next batch of wet grain. One batch cools and another dries at the same time.

6. The burner may not operate properly unless the slide in the shed wall is adjusted to allow some air to by-pass the grain in the cooling chamber. It is not necessary for the fan to pull all the air through the cooling chamber, because the warm grain will cool faster than the wet grain will dry. The slide adjustment is particularly important when drying small grain, which provides greater resistance to air flow than shelled corn or soybeans. This reduced air volume will also require less fuel to heat it to the proper drying temperature.

7. Cooled grain is moved from the cooling chamber, usually with an auger, to an elevator that conveys it to a storage bin or truck. This takes from 10 to 20 minutes, and drying goes on all this time.

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Capacity of the Drier

The drier was originally designed with 12-inch columns. Later tests showed that 18-inch columns, shown in the plan (inside), are satisfactory, particularly for shelled corn, and provide more capacity per foot of length. The 12-inch columns are satisfactory where only small grains are to be dried, and plans for such driers are available from the University of Illinois, Urbana.

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HOW TO BUILD DRIER

1. Place 4- by 6-inch skids (concrete foundation and sills may be used).

2. Assemble on the ground the studs and joists for each 2-foot section. Make sure that the two end sections have the joists on the outside of the studs as shown in the plan. Siding can then be easily attached after blocking is nailed to studs.

3. Set up sections and install upper plate (fig. 1).

4. Add 2- by 4-inch supports between 2- by 4-inch supports under cooling chamber (see plan).

5. Attach ¼-inch hardware mesh and metal fly screen to upper part of drying chamber and lower part of cooling chamber as shown in plan. Perforated metal with correct size of openings can be used in place of screen and mesh.

6. Build "A" frame sections for drying and cooling chambers. Dimensions are as shown in plan.

7. Install lower "A" frame first so that fastening can be done from drying chamber; place blocking between joists as shown in plan.

8. Install between drying and cooling chamber an airtight floor, preferably one that is fire-resistant (see fig. 2).

FIGURE 1.—Each 2-foot section of studs and joists can be assembled on the ground and then raised into position on skids or sills as shown.

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FIGURE 2.—Lower "A" section, lower slides, and airtight floor in place.

9. Build and install three sets of grain slides, one for the holding bin and two below the drying chambers. Note that the plan shows top slide with sliding sections below fixed section. This type of construction is recommended because this slide will be opened and closed with large amounts of wet grain above it. Exterior plywood, 3/8-inch thick, or metal, when available at a comparable cost, can be used for the slides.

10. Install upper "A" frame and fasten at each corner (see fig. 3).

11. Install hopper-bin floor.

12. Install roof, siding, and hinged covers.

13. Install 6-inch auger. Auger will require 1-hp. repulsion-induction-type motor to drive it at 200 revolutions per minute. It can be driven from either end of drying building.

14. Install inspection and clean-out window with blocking and weather stripping to make it airtight. Window is installed off-center to prevent interference with upper slide lever.

15. Some of the above steps may be varied, but steps 5 through 10 must be followed exactly or assembly will be difficult. If building is on skids, it can be moved to line up with grain bins and equipment. Building can be anchored if desired.

16. The airtight shed for fan and heater should be built of fire-resistant material. Provide a 12- by 12-inch slide in shed wall to by-pass some air when cooling grain. A walk-in door is also needed.

The use of wood is suggested for building the drier because of its availability and workability. However, metal is preferred whenever it is feasible to use it.

FIGURE 3.—"A" sections in place for drying and cooling chambers.